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ABSTRACT

In a teaching experiment, 16 face-to-face and 11 e-mail Finnish university students engaged in an argumentation course. The 19 students of the control group did not study argumentation. The course involved two lectures, exercises with argumentative texts, and face-to-face or e-mail seminar discussions based on these texts. The topics of the texts were: (1) sex roles and equality in education; (2) discipline problems in school; (3) the compulsory teaching of Swedish in school (a controversial educational topic in Finland); and (4) physical punishment as a child-rearing method. Free debate, role play, problem-solving, and panel discussion were the devices used in organizing the course. The level of the students' argumentation skills were measured before and after the course. Results indicated that the e-mail studies sharpened students' skills in identifying the relevant grounds from an argumentative text and choosing the correct grounds from different alternatives, while the face-to-face students improved in putting forward counterargumentation. The study suggests that argumentation skills can be promoted by short-term e-mail and face-to-face teaching and that practicing argumentation in different leaning environments develops different kinds of argumentation skills. The study also suggests that, in comparing different learning environments, relevant research questions seem to concern matters of dissimilarity rather than of superiority. (Contains 26 references.) (Author/MES)

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LEARNING ENVIRONMENTS FOR STUDYING ARGUMENTATION

- learning effects of e-mail and face-to-face study

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Abstract

In a teaching experiment 16 face-to-face and 11 e-mail Finnish university students engaged in an argumentation course. The 19 students of the control group did not study argumentation. The course involved two lectures, exercises with argumentative texts, and face-to-face or e-mail seminar discussions based on these texts. The topics of the texts were: 1) sex roles and equality in education, 2) discipline problems in school, 3) the compulsory teaching of Swedish in school (a currently controversial educational topic in Finland), and 4) physical punishment as a child-rearing method. Free debate, role play, problem-solving and panel discussion were the devices used in organizing the course. The level of the students' argumentation skills were measured before and after the course. The results indicated that the e-mail studies sharpened the students' skills in identifying the relevant grounds from an argumentative text and choosing the correct grounds from different alternatives, while the face-to-face students improved in putting forward counterargumentation. The study suggests that argumentation skills can be promoted by short-term e-mail and face-to-face teaching, and that practising argumentation in different learning environments develops different kinds of argumentation skills. The study also suggests that in comparing different learning environments relevant research questions seem to concern matters of dissimilarity rather than of superiority.

INTRODUCTION

A shift from the information society towards a *network society* is currently taking place. This shift is mainly a result of the rapid development of information technologies which have facilitated the transfer and availability of information as well as made global human communication possible. This process has brought new challenges to the educational system in developing new learning environments based on the use of networks.

A fundamental aim of higher education is to develop in people a critical attitude towards knowledge and the ability to present well-grounded arguments (Terenzini, Spinger, Pascarella & Nora, 1995). Argumentation and debating skills are needed when engaging in academic discussions, where it is essential to be able to assess the strengths and weaknesses of other peoples' standpoints, and to formulate one's own positions supported with relevant and adequate grounds. These skills are of particular value in the new network society in which people have to be able to cope with a large amount of information and select essentials from it. In this new situation the skill in assessing information critically from different points of view is important.

Recent studies have indicated that the use of networks, the use of e-mail in

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particular, has increased and enriched communication between people in educational settings (Ruberg, Moore & Taylor, 1996) as well as in organizations (Lucas, 1998). Furthermore, learning environments based on interaction and debates between students have proved beneficial when the aim has been to promote students' argumentation skills (Littlefield, 1995; Marttunen 1997, 1998). Networked learning is especially relevant in higher education where the central aims are to promote argumentative dialogue and to develop students' argumentation and debating skills (Banta, 1993; Haughey & Anderson, 1998). However, the educational use of networks is problematic because new technological applications are continually being invented, and there is too little research-based knowledge on how to use these technologies for learning purposes. The aim of this study is to enrich knowledge about learning in networked environments.

REVIEW OF RESEARCH

Previous studies have indicated that the use of e-mail has led to learning outcomes as good or better when compared with the results of such traditional teaching methods as the lecture (Hacker & Sova, 1998) and face-to-face teaching (Alavi, 1994). When comparing the content of e-mail and face-to-face interaction Quinn, Mehan, Levin and Black (1983) found that in a face-to-face situation teachers presented more questions to students whereas in e-mail discussion the students' answers were longer and more versatile. They also found more critical interaction between students in e-mail than face-to-face discussions. Similar results were found in a recent study by Marttunen and Laurinen (1999) in which students' e-mail discussions proved more structured and exhibited more well-grounded opinions and counterargumentation than face-to-face discussions. Face-to-face discussions were, by contrast, more incoherent and included a lot of different opinions, short responses to these, and arguments whose rationale was somewhat obscure. Garton and Wellman (1995), and Olaniran (1994) found that it took less time to achieve agreement between participants in a face-to-face environment compared to e-mail communication. The cost of time was compensated, however, by the better decision quality and the diversity of original ideas when e-mail was used.

Studies that have focused on students' cognitive processes during e-mail discussions have shown improvement in students' argumentation and critical thinking skills in the course of the discussions (Marttunen, 1997; Newman, Johnson, Cochrane & Webb, 1996). Murphy, Drabier and Epps (1998), and Austin (1997) also report on findings indicating that on-line discussions encourage reflection and stimulate critical thinking.

This study investigates differences and similarities between face-to-face and e-mail environments in the learning of argumentation skills using the same learning material and discussion topics. The problems addressed by the study were the following: 1) Is it possible to develop argumentation skills during a short-term course in argumentation? 2) Are there any learning differences between face-to-face and e-mail environments?

METHOD

Subjects and Design of the Study

The subjects of the study consisted of 46 university students. A majority of them were women (82%) and students of education (80%) in the later stages of their academic studies. In addition, most of the subjects (82%) were full time students, while nine students attended the Open University. Three teachers, who all belonged to the same university department, also participated in the study.

The study was quasi-experimental in nature. To collect the data a teaching experiment was carried out during the 1998 spring term at the Department of Education and at the Open University in the University of Jyväskylä, Finland. For the purposes of the experiment the students were divided into four experimental groups (two face-to-face groups and two e-mail groups) and a control group. The groups were matched so that both men and women as well as younger and older students were represented in each group. The students in the experimental groups participated in a ten-week argumentation course, while the students in the control group did not have any instruction in argumentation. All the subjects took part in a course pretest and posttest measuring the level of their argumentation skills. The design of the study is shown in Table 1.

Table 1. Design of the study

Experimental groups (n = 27)			
Matching Face-to-face 1 (*n* = 7)	Pretest	Argumentation studies	Posttest
Matching Face-to-face 2 (*n* = 9)	Pretest	Argumentation studies	Posttest
Matching E-mail 1 (*n* = 5)	Pretest	Argumentation studies	Posttest
Matching E-mail 2 (*n* = 6)	Pretest	Argumentation studies	Posttest
Control group (n = 19)			
Matching	Pretest	----------	Posttest

Learning Material

The learning material of the course consisted of argumentative writings taken from newspapers and periodicals as well as scientific texts. The writings were based on four educational themes: 1) sex roles and equality in education; 2) discipline problems in school: causes and proposed solutions; 3) the compulsory teaching of Swedish in school (a currently controversial educational topic in Finland); and 4) physical punishment as a child-rearing method. These educational themes were chosen since it was supposed that they would readily arouse conflicting opinions among the students, and thus, effectively bring about argumentative discussions. Each text package also included exercises in argumentation.

Learning Environments

During the ten weeks of study, the students in the experimental groups practised argumentation by engaging in argumentative discussions on the basis of the learning material. The discussions in the *face-to-face groups* were real-time and oral in nature. Eight seminar sessions were held during the ten weeks. Two of the weeks were reserved for lectures. Each seminar session was based on different text material and the exercises relating to it. The students read the texts and did the exercises before each seminar session. Both of the two face-to-face groups had its own teacher. The task of the teacher was to direct the discussions so that the students would present well-grounded arguments on the topics encountered in the texts, and counterarguments to other students' opinions. The aim was to encourage active debates between the students. The teacher who taught one of the face-to-face groups was the lecturer.

The discussions in the *e-mail groups* were, by contrast, textual and not real-time in nature. The discussions were based on the same variety of texts and exercises as in the face-to-face groups. The students read the texts and did the exercises before taking part in the discussions. E-mail study in each group was based on the exchange of e-mail messages between the participants of the group. There was a distribution list attached to the e-mail program (Pine for Unix) which enabled many-to-many communication within the groups. Students had to write at least three messages a week in order to pass the course. The messages were supposed to include both the students' own well-grounded arguments relating to the learning material and critical comments directed at other students' positions.

Both e-mail groups were directed by the same e-mail tutor. The tutor concentrated on directing the discussions so as to ensure that the students would present a number of well-grounded arguments, counterarguments, and refutations of other students' counterarguments. During the course the tutor also provided the students with personal and collective feedback, including suggestions on how to improve the level of argumentation in their messages.

Working Methods

Free debate, role play, problem-solving and panel discussion were the devices used in organizing the seminar discussions. Free debate and role play were based on individual working, while problem-solving and panel discussions involved group working. In the face-to-face seminars all four working methods were used, while for the e-mail students, only free debate and role play were involved. The reason for this was that e-mail was not thought to provide a suitable environment for group working (see Garton & Wellman, 1995).

During *free debate*, students presented their own grounded opinions on questions encountered in the learning material, as well as counterarguments to claims encountered in the material and in other students' messages. In *role play*, half of the students were given a point of view that they had to support in the ensuing discussion, and the other half were given an opposed standpoint to support. The aim of the *problem-solving discussion* was to reach a common understanding between the members of the group on the given problem. In the *panel discussion* the students were divided into two subgroups, who were assigned opposing points of view on a "controversial"

topic. The groups encountered each other in a panel debate, in which the task of the students was to work as a group and defend their standpoint according to the strategy they had created previously.

Argumentation Course

The ten-week argumentation course involved 1) lectures (2 x 2 hours), 2) exercises with the learning material, and 3) face-to-face or e-mail seminar discussions using the different working methods. The purpose of both the lectures and the exercises was to support the seminar working. The exercises introduced the students to the content and argumentative structure of the text material, and in this way prepared them for the subsequent argumentative discussions relating to each text package in the seminar sessions. In the first lecture session the students were taught the main conceptual apparatus of the argumentation process which was to be utilized during the seminar discussions. In the second lecture the students' knowledge of argumentation was deepened by teaching them the fundamentals of argumentation analysis (Toulmin, Ricke & Janik, 1984).

Data Collection

The level of the students' argumentation skills was measured by a pretest before the course and by a posttest after it. The measurement instrument consisted of four tasks. In the task concerning *analysing an argumentative text* the students were given an argumentative extract from the book The Hidden Curriculum (Broady, 1986). The text dealt with progressive pedagogy from the point of view of different social classes, and included a claim stated by the author and several grounds in support of that claim. The students were asked to analyse the text by identifying the main claim in the text and the grounds advanced in support of it. They were also asked to draw their own conclusion on the basis of the grounds they had found in the text. In the task relating to *composing one's own argument* the students were asked to formulate a claim on a controversial theme that was given to them, and to write grounds in support of their claim. The theme was "Refugee policy in Finland" in the pretest, and "The teaching of faith in religious instruction" in the posttest. The main criterion for the selection of the themes was that they were current and controversial in such a way that there should be no difficulty in forming a personal opinion about them. The task concerning *commenting on a grounded statement* consisted of a provocative opinion, four strong and even false grounds that were provided in support of that opinion, and a false conclusion. The students were asked to comment freely on the text. The *judging task* consisted of two different subtasks. In the first task the students were given three grounds and three conclusions. They were asked to evaluate the conclusions and to choose the one they judged to be the right one. The second task included a claim and five grounds. The students were asked to evaluate the grounds and to choose the ones they thought supported the claim.

Data Analyses

Analysing an Argumentative Text

The students' answers to the tasks concerning the argumentative text were analysed by utilizing the conceptual apparatus provided by Toulmin (Toulmin *et al.*, 1984). According to Toulmin, an argument can be divided into several components of which the main ones are the *claim* and the *grounds*. The claim can either be presented in a form of conclusion (Voss, Blais, Means, Greene & Ahwesh, 1986) or it may (or may not) include a conclusion. As both the claim and the conclusion indicate the opinion of the writer of the argument the purpose of the grounds is to provide evidence for them.

The students' answers were analysed by focusing separately on claims, grounds, and conclusions. The analysis of the *claims* clarified whether the claim the students had identified included a contention (X1), whether it focused on a single sharp contention (X2), whether the content of the claim was clear and understandable (X3), and how well the substance of the claim corresponded to the substance of the most essential claim in the text (X4). The variables X1, X2, and X3 were dichotomous (0 = no; 1 = yes), and variable X4 had three values (0 = badly, 1 = quite well, 2 = well). The Simple Matching Similarity Ratio between variables X1, X2, and X3 varied from .95 to 1.00 (see Anderberg, 1973). This means that to a large extent they measured the same thing. For this reason they were aggregated to form a new variable (S1) which described the overall clearness of the claim.

The *grounds* the students identified in the text were analysed by investigating how well they covered the grounds actually presented in the text (X5). The text included six broad grounds that supported the claim. If the student had found a half or more of them, s/he was interpreted to have identified the grounds well (value 2), if two grounds were found the student had succeeded moderately (value 1), and if one or none of the grounds were found the student had succeeded badly (value 0).

The analysis of the *conclusions* focused on the justification for the conclusion (X6). A well-justified conclusion (value 2) was supported by the grounds each individual student had identified in the text. The conclusion was partly justified (value 1) if it was supported by some of the grounds, and non-justified (value 0) if none of the grounds supported it.

Composing One's Own Arguments

The analysis of the arguments the students composed by themselves was, accordingly, based on separate analyses of claims and grounds. The analysis of the *claims* was similar to the analysis applied in the analysis of an argumentative piece of text, and it focused on the form (X7), focus (X8) and clarity (X9) of the claim. Similarly, variable S2 indicated the general clearness of the claim, and it was formed by aggregating variables X7, X8, and X9 (The Simple Matching Similarity Ratio: .95 - 1.0). The analysis of the students' *grounds* focused on the accuracy of grounding (X10). Accurate grounding (value 2) was relevant in regard to the claim and offered a wide scope of support for it (see Bacig, Evans, Larmouth & Risdon, 1990). Moderate grounding (value 1) offered narrower support, and the grounds might overlap each other. Grounds classified as non-accurate grounding (value 0) were mainly irrelevant and too few.

Commenting on a Grounded Statement

The students' comments on a grounded statement were analysed by focusing on how analytical (X11) and counterargumentative (X12) they were. The students' comments were interpreted to reflect their understanding of what is a relevant way to comment on and analyse an argument. In an *analytical comment* (value 2) a student had responded to most of the elements of the argument: to the claim or to the conclusion, and at least to three of the four grounds. The answers classified as *in-between* (value 1) included responses to two or three elements, and in a *non-analytical comment* (value 0) none or only one element was responded to. In a *counterargumentative* comment (value 2) the student had stated criticism against the claim or conclusion of the argument, and had also supported his/her counterclaim with at least one relevant ground. A *non-counterargumentative* comment (value 0) did not include criticism against the claim or the conclusion at all, while the comments of the *middle category* (value 1) included criticism but no supporting grounds.

Judging the Multiple-choice Tasks

In the analysis of the judging tasks the different possible choices were scored. In task 1, in which the students were asked to choose the correct conclusion (X13), the correct alternative (value 2) was the conclusion that was supported by all of the three grounds. A partly correct conclusion (value 1) was supported by one or two of the grounds, and a false conclusion (value 0) by none of the grounds. In task 2, relating to the choice of the correct grounds (X14), two of the five grounds were formulated to support the claim. The range of the scoring was from 0 to 2. In the analysis one point was awarded for a correct choice and one point subtracted for an incorrect choice.

Reliability of the Analyses

The reliability of the analyses was determined by asking another person to classify 19 (20%) cases independently. The inter-rater correlation coefficient between the analyses of the two classifiers was used as an indicator of reliability. In the cases of the dichotomous variables (X1 - X3, X7 - X9) reliability was determined by using the Simple Matching Similarity Ratio, and it varied from .95 to 1.0. In the cases of the other variables (X4 - X6, X10 - X12) the Pearson Product Moment Correlation Coefficient (r) was used. The reliability of the variables X4, X5, X6, X11 and X12 varied from .83 to .95. In the case of variable X10 the reliability in the pretest was .42, and in the posttest .76.

Pretest Scores of the Students' Argumentation Skills

The differences in the level of the students' argumentation skills in the pretest between the different groups were analysed by one-way analysis of variance (Anova). The results indicated that the students' skill in commenting on an argument in an analytical way (X11) was different in the different groups ($F = 6.87$; $df = 2, 47$; $p < .01$). The students' other skills were at the same level. The finding that only one of the students' skills was at a different level in the different groups at the beginning of the course suggests that the unrandomization of the study groups did not affect the results.

The average level of the students' argumentation skills proved fairly low in the pretest (Table 2). In particular, the students' skills in drawing justified conclusions (X6), composing accurate grounds (X10), and putting forward counterargumentation (X12) were weak. Their skills in finding the most essential claim (X4) and the supporting

grounds (X5) in the text, commenting on an argument in an analytical way (X11), and choosing the correct grounds from different alternatives (X14) were moderate, and only the skills in formulating clear claims (S1, S2), and choosing the correct conclusions from the given alternatives (X13) proved good.

RESULTS

Table 2. The level (*M*) of the students' argumentation skills in the different groups

	Group											
	Face-to-face (n = 16)				E-mail (n = 11)				Control (n = 19)			
Variable	Pr	Ps	$t(df)$[2]	p	Pr	Ps	$t(df)$[2]	p	Pr	Ps	$t(df)$[2]	p
Analysing												
Claims												
S1, Clearness[1]	1.66	1.63	-.40(15)	ns	1.76	1.82	.40(10)	ns	1.79	1.79	0.0(18)	ns
X4, Substance	1.13	1.0	-.60(15)	ns	1.18	1.55	1.8(10)	ns	1.37	1.05	-2.1(18)	ns
Grounds												
X5, Identification	1.25	1.38	.50(15)	ns	1.00	1.55	2.2(10)	*	1.05	1.32	1.2(18)	ns
Conclusions												
X6, Justification	.31	.75	2.0(15)	ns	.78	1.0	1.5(8)	ns	.79	1.05	1.1(18)	ns
Composing												
Claims												
S2, Clearness[1]	1.79	1.79	.00(15)	ns	1.76	1.82	.30(10)	ns	1.79	1.82	.30(18)	ns
Grounds												
X10, Accuracy	.71	1.07	1.8(13)	ns	.70	1.10	1.3(9)	ns	.79	1.16	2.1(18)	*
Commenting on												
X11, Anal. way	1.19	1.44	1.3(15)	ns	1.64	1.64	.00(10)	ns	.68	1.05	1.8(18)	ns
X12, Counterar.	.88	1.50	3.1(15)	**	1.27	1.55	.90(10)	ns	.95	1.05	.50(18)	ns
Judging												
X13, Conclusions	1.88	1.44	-2.2(15)	*	1.40	1.30	-.30(9)	ns	1.89	1.22	-4.8(17)	***
X14, Grounds	1.50	1.75	1.0(15)	ns	1.27	1.82	2.2(10)	*	1.47	1.74	1.4(18)	ns

Note: Range of the variables is from 0 to 2.
[1]An aggregated variable.
[2]T-test with paired comparisons.
* $p < .05$; ** $p < .01$; *** $p < .01$.

The results, shown in Table 2, indicate that the e-mail students but neither the face-to-face students nor the students in the control group improved in their ability to identify the grounds from the text (X5), and to choose the correct grounds from different alternatives (X14): in the e-mail groups the means of variable X5 in the pretest and posttest were 1.00 and 1.55 ($p < .05$), and the corresponding means of variable X14 were 1.27 and 1.82 ($p < .05$). The face-to-face students, instead, improved in the skill of putting forward counterargumentation (X12): their mean increased from 0.88 to 1.50 ($p < .01$). In addition to that, the skill of the face-to-face and control groups in choosing the correct conclusions from the different alternatives (X13) had decreased.

Students' skill in composing accurate grounds (X10; Table 2) had improved only in the control group. It should, however, be noted that the actual difference between the control group's scores in the pretest and posttest was 0.37, while it among the e-mail groups was even bigger (0.41), although not statistically significant due to the small number of subjects (n = 11). If there had been more subjects in the e-mail groups the increase in this skill would, most probably, have been statistically significant.

Concerning the students' ability to choose the correct conclusion (X13) it is worth noting that the task was different in the pretest and posttest. In addition, since the results within each of the groups indicate a decrease in skill, it is obvious that the task in the posttest was more difficult. This also, presumably, affected the poorer results in the posttest. Furthermore, since the control group did not engage in the studying of argumentation, their skills can be assumed to have remained at the same level throughout the course. For this reason, a second analysis was carried out in which the difference between the pretest and posttest of the control group was standardized as zero. This enabled the decrease in the results of the face-to-face and e-mail groups to be interpreted as indicating development in this skill. However, the results of the second analysis showed that the improvement was not statistically significant.

Although the results suggest that the students' skills improved during the course, this was not indicated by all the variables: the students' abilities to formulate clear claims (S1, S2), to identify the main claim from the text (X4), to draw justified conclusions (X6), and to comment on an argument in an analytical way (X11) remained at the same level throughout the course. With regard to the variables S1, S2, and among the e-mail groups variable X11, the obvious reason for the similar results in the pretest and posttest is the ceiling effect (Borg & Gall, 1989, 303, 729): since the students' skills were already good at the beginning of the course, it was probably difficult for them to improve them further in such a short period of training. Furthermore, in terms of the task in which the students were asked to draw their own conclusion on the basis of the claim and grounds they had first found in the text (X6), it should be noted that the task was, at least to some extent, inconsistent and obscure. The students may have experienced the task as confusing when they were asked to draw a conclusion on the basis of information that already included a conclusion in the form of the claim. Thus, it is possible that the validity of the task is low, which may explain why the comparison of the pretest and posttest scores did not indicate development even though argumentation skills were practised. Finally, it is worth noting that, unlike the other skills measured in the tests, the skill in identifying the main claim in the text (X4) was not practised by the students during the course. Hence, it is understandable that the students' skill in identifying the claim did not improve.

DISCUSSION

The study suggests that different kinds of argumentation skills are developed in different learning environments.E-mail course sharpened the students' skills in identifying the relevant grounds from an argumentative text and choosing the correct grounds from different alternatives, while the face-to-face course fostered the students' skill in putting forward counterargumentation. When training is based on asynchronous e-mail interaction students have plenty of time in which to identify

claims, grounds and counterarguments in each others' texts and evaluate the relevance and irrelevance of different kinds of grounds. This kind of practice thus promoted the students' ability to analyse argumentation. Accordingly, the results suggest that synchronous face-to-face discussion promotes the ability of students to rapidly put forward counterargumentation towards other people's inadequate or incorrect statements.

It is worth noting that when doing their home exercises the face-to-face students had to respond to the written texts, whereas during the seminar hours they practised oral argumentation. The e-mail students, instead, worked only with the written discourse. The face-to-face students would obviously have needed more opportunities to analyse each others´ discourse without the limits of the capacity of working memory. In respect of the form of discourse, e-mail provides an excellent channel for practising argumentation due to the semi-oral nature of the language used in letters. The question remains whether, if it were possible to combine semi-oral and oral discourse when practising argumentation, students would then learn to be both analytical and ready to put forward counterarguments during academic debates.

From the point of view of higher education pedagogy it is important to note that the argumentation course had many features that can be considered as promoting the students' possibilities to engage in constructive learning. First, the learning material in the study was based on newspaper writings and articles on issues that were familiar and meaningful to the students. Second, during the course the students engaged in mutual discussions on the basis of a critical examination and reflection on the learning material. These features are in accordance with the views of Jonassen, Davidson, Collins, Campbell, and Haag (1995), who state that constructivist environments engage learners in knowledge construction through collaborative activities that embed learning in a meaningful context. They also emphasize the importance of reflection on what has been learned through conversation with other learners. Furthermore, the students' positive learning results in this study also suggest that the students construction of new knowledge was promoted.

The results of this study suggest that argumentation skills can be promoted by short-term teaching interventions. Similar findings have been found in many previous studies (Littlefield, 1995; McMillan, 1987). However, there are also results that question the effects of short-term courses and suggest that along with teaching interventions, the skills are developed as a result of the students' natural learning experiences, especially in academic environments (Pascarella, 1989; Voss *et al.*, 1986), and through out-of-class experiences as well (Terenzini *et al.*, 1995). Although some improvement in skills seems to take place by means of short-term teaching too, it is a complex task to determine how permanent the products of learning are, and to what extent learning is affected by other factors than teaching. Nevertheless, the results of this study indicated that both face-to-face and e-mail teaching develop students' skills. Short-term courses are, thus, appropriate in terms of learning of argumentation and also worth developing further.

With regard to the ways the teaching of argumentation should be studied in the future it is worth noting that learning of argumentation in this study proved different in face-to-face compared to e-mail environments. In comparing different learning environments relevant research questions seem to be at least the following: what kind of skills are promoted by the use of learning environments based on different media, and how should the conditions of learning in such kind of environments be developed?

The relevant questions seem to concern matters of dissimilarity rather than of superiority. Knowledge relating to the nature and conditions of learning obtained by means of different communication media would also help educators to make use of those teaching methods that best support the learning of different kinds of skills.

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